



Film Style and Technology in the Thirties

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aegis of these two authorities, Capitalism and the Church, Western civilization marches its relentless way to the apocalypse of *A Clockwork Orange*. Barry, now impotent, accepts a cash compensation for his mutilation and exists with his mother, subdued past all further defiance.

It is not that Kubrick is suggesting the instinctual man be permitted unrestricted expression of himself, but that man recognize and acknowledge the savage in himself and develop cultural forms based upon the frank acceptance of that acknowledgment. Joseph Conrad, a writer known to Kubrick, has voiced a variant of Camus's only significant philosophical question. Stein, a character in the novel *Lord Jim*, claims that the real question is not "To be or not to be," but "How to be." He concludes, as Kubrick concludes, that man must "immerse" himself "in the destructive element," that is, man must embrace the savage in himself in order to control him. In the duel between Barry and his stepson, Barry is the true victor. Closer to his instinctual self than any other character in the story, Barry is able to control his rage and fire his pistol into the ground after Bullingdon's pistol misfires. It is true that Barry is distraught over the death of his

son Bryan, but O'Neal's performance in the scene does not in any way suggest his indifference to life. Instead, he struggles to control his fear and his rage. He is thus able to stand his ground to receive Bullingdon's second shot which shatters his leg. In so doing, he achieves a dignity that Bullingdon betrays with the joyful expression of gratified rage when he hears Barry's cry of pain. Although he is deformed by his civilization, Barry has achieved the only meaningful victory in the movie, the triumph over the savage in himself. It is only a passing victory, however. Kubrick's point is clear enough: man must embrace the Alex in himself to be whole again. He must reject his past, his cultural traditions, the dead moral scheme that falsifies life and deforms, rather than controls, the instinctual man.

The charge that Kubrick's later movies are devoid of meaning is thus nonsensical. The charge that he is ponderous and dull is comprehensible only if his ideas are ponderous and dull. The evidence of his trilogy on Western civilization supports the claim that he is one of America's top film directors. He is more than that. Stanley Kubrick is a critic of his age, one of its interpreters and one of its artists.

BARRY SALT

Film Style and Technology in the Thirties

Now that some interest has arisen in the history of the influence of film technology on the forms of films, there has been an unfortunate tendency to exaggerate its importance, whereas in truth it appears that, as far as the more interesting aspects of movies are concerned, technology acts more as a loose pressure on what is done rather

than a rigid constraint. For instance, one can connect the move towards faster cutting in the middle thirties with the introduction of "rubber numbering" (or "edge numbering") of the cutting copies of the sound and picture tracks, but an opposite tendency towards longer takes, which began at the end of the thirties, seems to be

independent of any of the technical developments of the period. And a complex train of events involving aspects of sound recording and film stock development relate to the rise of background projection and total studio shooting that so distinguishes the later thirties from the early thirties.

So in this article these matters, and also other aspects of the general movement of the formal stylistic features in the mainstream cinema of the thirties, are considered in relation to the technological developments of the period. The emphasis is strongly on American practice, but the state of European developments is mentioned from time to time. The analytical approach to film style used here has already been demonstrated more fully in some respects in *Film Quarterly*, Vol. 28, No. 1, and since then extended somewhat, and the general attitude taken is that it is impossible to establish what is interesting about a particular film unless one knows the norms holding in general for other films of the same kind made at the same time and place. Ignoring this principle has led people to describe features of particular films as remarkable, when they are in fact quite commonplace in the context of their period, and although this error is much more common with early cinema, one instance in connection with sound editing can be mentioned here.

At the beginning of the thirties editors were beginning to realize the importance of what might be called the "dialogue cutting point" for making weak (i.e., smooth, un-noticeable) cuts when cutting from one speaker to another in a scene. In general the weakest cut from a speaker to the shot of his listener, who is about to reply in the succeeding shot, will be made while the last syllable of the last word of the speech is still being spoken. Some editors cut at the very end of the last syllable, which is almost equally acceptable, but virtually none cut in the middle of the pause between the two speeches, or just at the beginning of the reply. (Some uncertainty about this point is still visible in Capra's *Platinum Blonde*—1931.) Of course deviations from this point can be made for reasons of emphasis and expression in general, most notably cutting to a listener's reaction in the middle of a speech. Curiously enough this prin-

ple has never been written down in books on editing technique, and presumably it is passed on to apprentice assistants at the editor's knee, but in any case it should be immediately obvious to any would-be editor from watching a couple of films. But in a recent article by Raymond Bellour on *The Big Sleep* in *Screen*, Vol. 15, No. 4, p. 17, several lines are spent in discussing one instance of this standard dialogue cutting point as though it were something unique and remarkable rather than the usual thing.

The picture of the technology situation has been put together from information obtained from complete runs of *The American Cinematographer* and *The Journal of the Society of Motion Picture Engineers*, together with *The Cinematographic Annual*, Vols. 1 and 2 (American Society of Cinematographers, Hollywood 1930 and 1931), *Recording Sound for Motion Pictures* (ed. Lester Cowan, McGraw-Hill, 1931) and *Motion Picture Sound Engineering* (Research Council of A.M.P.A.S., Hollywood, 1938). Some several hundred films of the period have been considered in the light of this information, and also of the present author's film-making experience at the professional level, principally as a cameraman, but extending a little way into most other areas.

DEPTH OF FIELD AND OTHER PHOTOGRAPHIC VARIABLES INFLUENCING THE FILM IMAGE

Depth of field (often erroneously called depth of focus) is one of the central factors controlling the appearance of the film image, and it is really necessary to get a clear understanding of the way it is related to other variable factors if one is to appreciate the interconnections between the visual qualities of movies and film technology. The four central quantities whose variations are strictly connected with one another are Depth of Field, Lens Aperture, Focal Length of Lens, and Lens Focus.

Depth of Field is the range of distance in front of the camera lens inside which objects produce sharp images as seen on the cinema screen when the film is finally projected. The boundaries of this range of sharp focus are rather approximate, as objects just outside it are only slightly unsharp,

and the casual glance at the cinema screen may not reveal this. The range of sharp focus as it appears on the ground-glass screen of a camera view-finding system is not necessarily the same as that on the cinema screen, though usually close to it.

Lens Aperture is the size of the variable opening in the iris diaphragm built into the middle of the lens. Its size is measured in "f numbers" or "stops," and these f numbers are inversely related to the actual diameter of the lens diaphragm opening. The basic series of f numbers runs f 1, f 1.4, f 2, f 2.8, f 4, f 5.6, f 8, f 11, f 16, f 22, f 32. Each of these f numbers are said to differ from the next one by "one stop," and going from one to the next either halves or doubles the amount of light passing through the lens to the film. Intermediate f numbers are also possible, and tend to occur in the specification of the maximum aperture of a lens. The exposure is controlled by changing the amount of light falling on the scene and/or changing the lens aperture so that just the amount of light gets through the lens as appropriate to the film stock being used. "Faster" film stocks require less light through the lens than "slow" stocks, and so give the cameraman the option of decreasing the light level on the set or leaving it the same and reducing the lens aperture, which can increase depth of field (see below).

Focal Length of a lens is the distance behind its "optical center" of the plane in which the image of an infinitely distant object is formed. The "angle of view" of a camera lens is inversely proportional to its focal length, so short focal length lenses have a wide angle of view, and are colloquially referred to as wide-angle lenses, and long focal length lenses, some of which also have "tele-photo" type construction, have a narrow angle of view.

There is no definite criterion for what constitutes a "standard lens," though some fairly recent experimental work suggests that for the Academy frame focal lengths between 35mm and 40mm give most viewers a feeling of correct perspective. Before World War I some cameramen regarded even a 75mm lens as standard, though in the twenties all came to agree on 50mm as standard. This more or less continued to be the

case through the thirties, but by the late forties there were many who had come to regard 35mm focal length as standard. Widescreen projection in the fifties continued the trend, but also introduced complexities which it would be out of place to discuss here.

Lens Focus is of course the distance at which the lens focus is set to produce the very sharpest images of objects.

Now the value of any one of these quantities is determined by the values of the other three, but it is usual to consider the effect on the depth of field of holding two of them fixed and varying the third. The results are nowadays set down in depth of field tables, but these did not exist in the thirties, and cameramen then had to rely on experience to predict the depth of field that would appear on the screen. So, given that the other two factors are constant, depth of field increases with: (i) Increase of distance at which the lens focus is set—up to a certain point called the hyperfocal distance; this variation is of no help in achieving "deep focus." (ii) Decrease of focal length of lens—that is, moving to wider angles of lens, which at the same time introduces perspective distortion. (iii) Reduction of lens aperture. This requires the use of faster film stock and/or increase of light levels on the set. To reduce the aperture by one stop requires a doubling of the light level, and as is well known, this in turn doubles the already considerable electricity consumption of the studio. But if one was prepared to pay the price it was possible, even in the early twenties, to raise the light level on studio sets to the point where considerable depth of field was obtained even with the slow (approximately 20 ASA) film of that time. An isolated instance of this occurs in von Stroheim's *Foolish Wives* (1921), where in a few scenes the interiors have been lit to match the level of the sunlit exteriors visible through doors, etc., and consequently the lens aperture is about f 5.6 or f 8, and sharp focus is carried from Medium Shot to Very Long Shot. This is not deep focus in the post-Toland sense, but it is on the way there, and it could have been pushed further by doubling up the arc lights used, and by using a wider angle lens, if there had been a specific desire to increase depth of field further, instead of this result having been

achieved accidentally in pursuit of other ends.

FILM STOCK AND PROCESSING

At the beginning of the thirties the most commonly used negative stock continued to be Eastman Kodak panchromatic negative of the type introduced in 1928, but similar negative materials were also available from Agfa, Dupont, and Pathé. All these had slow emulsions that were used as though they had a speed of around 20 ASA in present-day terms, although there was no film speed rating system in use at that time. The faster Agfa negative which was already available, and the Eastman Supersensitive Negative which became available in 1931, were not in general use in Hollywood, except for filming the odd largish-scale night exterior. The principal reason for these negatives not being used to secure either lower light levels on the sets, or alternatively greater depth of field in the photography, was that they had noticeably greater graininess (as faster film stock usually does) and hence gave poorer definition in the image. So photography on interiors continued to be at maximum aperture (f 2-f 2.8).

New improved duplicating negative and positive stocks were made available by Kodak in 1930 and 1933 respectively, and these were directly connected with the developments in optical printing which will be discussed below. Most important also for special effects was Eastman Background Negative introduced in 1933 in response to Hollywood's desire to employ more background projection. This negative had very fine grain, and made it possible to obtain shots whose graininess would not be evident when projected onto the new giant background projection screens. In this case the demand very definitely produced the technical development, which is not usually the case, but the causal chain can be traced back even further to the exigencies of sound recording at this period.

In 1934 Agfa-Ansco introduced their 32 ASA Superpan negative to the American market, and the next year Kodak riposted with Super X which was approximately 40 ASA. These new faster stocks had better definition than their predecessors, but the decisive innovations occurred in 1938, when Eastman Kodak introduced Plus X

and Super XX with speeds equivalent to 80 ASA and 160 ASA respectively, and Agfa introduced Supreme and Ultrapan (64 ASA and 120 ASA). Of these new materials, Plus X immediately proved the most successful, for it gave definition comparable to the earlier slow stock for the first time, and in fact the vast majority of Hollywood features were shot with it for many years onwards. But in the later thirties the extra two stops of speed Plus X gave were never used to stop down by that amount from the usual maximum lens aperture, and so secure increased depth of field. On the contrary, the switch to Plus X was mainly used to economize on the light levels on the sets.*

However not quite all the speed advantage of the new stocks was absorbed in this way. To a certain extent they were over-exposed rather than being used with the light level intended for a given aperture. This over-exposure was compensating for by giving the negative reduced development, and this resulted in a flatter print, i.e., there were more middle greys in the image, and less true blacks and whites. MGM and RKO were the studios which went furthest in this direction, and all in all this practice was responsible for the distinctive pearly-grey look of many late thirties films when compared with the more contrasty films of the early thirties.

LIGHTING IN THE EARLY NINETEEN-THIRTIES

The principal lighting on studio sets during the twenties had been provided by arc lights, but these produced a humming noise when operating, and this made them useless for synchronous sound filming. By the beginning of 1930 electrical circuits to silence the hum had been devised and produced, but in most studios in that year their use was extremely limited, and most of the coverage for synch-sound shots continued to be achieved with the less intense, but silent, tungsten light sources. However Fox had already returned to the principal use of arc sources, and the result was the slightly sharper shadow and modelling to

*In 1937 typical values were 250-400 foot-candles for black and white filming and 800-1000 foot-candles for Technicolor, while in 1940 typical values were 75-150 foot-candles for black and white and 150-400 foot-candles for Technicolor.

be observed in their films of that year, when compared with those from other studios.

In 1931 all studios had returned to the free use of arcs when convenient, but the majority (80%) of lights used continued to be various types of tungsten light. This was no doubt in part to realize the worth of the investment already made in these incandescent lighting units, but also in part because cameramen had come to appreciate the unique qualities of lighting that could be achieved with some of them. This was particularly true of the various kinds of floodlights with hemispherical metal reflectors containing tungsten bulbs of up to 1 kw, which gave a much softer light than any arc floodlight. Indeed in general the light from tungsten source lighting units was softer than that from equivalent units with arc sources, and when used for figure lighting they produced attractive soft-edged shadows on the face. Some cameramen took more advantage of these possibilities than others, but Victor Milner can stand as an example of those who exploited the softness of tungsten light extensively in such films as *Ladies Man* (1931), where the key lighting is done with tungsten floodlights even in Long Shot, and the cast shadows as well as the modelling shadows are as soft as can be achieved, short of using the type of "soft light" unit only available in recent decades. Milner persisted with this approach, in the lighting of closer shots at least, for the rest of his career.

SOME THINGS DONE BY CAMERAMAN JAMES WONG HOWE

In general it is not possible to isolate a consistent individual recognizable style in the work of even the best cameramen; there is no obvious connection between the strong chiaroscuro look of *Murders in the Rue Morgue* and the rather pedestrian mid-key look of *Back Street*, both photographed by Karl Freund for Universal in 1932. Nevertheless there are numerous occasions when individual cameramen achieve strikingly original results, and in the early thirties James Wong Howe stands out in this respect.

In this period James Wong Howe tried out the possibilities of using a fairly wide-angle lens (25mm) in various unusual ways. In ordinary

Hollywood practice this lens was only rarely used, when the constrictions of an awkward set prevented a Long Shot being obtained in any other way, but Wong Howe used a 25mm lens on *Transatlantic* (1931) specifically to secure increased depth of field. The result was far from being deep focus in the modern, post-Toland sense, which strictly speaking means sharpness of focus from Big Close Up to Long Shot; the range achieved by Wong Howe was only from five feet to 30 feet, which is from Medium Shot to Long Shot with a 25mm lens. (These figures mean that the aperture used was approximately f 4, and the light levels would have been little more than those usual at this period.)

Less well known is that Wong Howe used a 25mm lens to get the close shots in *Viva Villa!* (1934) and also used long focal length lenses to shoot the massed battle scenes, an exceptional inversion of the usual procedures at that time.

Finally, *The Power and the Glory* (William K. Howard, 1933) contains a piece of exceptional lighting in the scenes in the tycoon's office, where Wong Howe somehow managed to duplicate exactly the fall of diffuse north light coming from windows to one side only. There is no back light or light from any other angle, and the effect is exactly what it would be in the real situation, or if using modern "soft lights" in the window positions. Ignoring a few instances involving close shots of people in other films at other times, this is the only instance the author has noted of anything before recent years that could reasonably be called "north lighting" applied to a studio scene.

It would appear that James Wong Howe was not encouraged in such individual efforts, as he did not do anything very unconventional again till the fifties; and indeed in general the later thirties and early forties were a period of conformism in all respects in films made everywhere. Directors who had a taste for experiment like William K. Howard were also not encouraged.

LIGHTING IN THE LATE THIRTIES

The important development in lighting practice in the latter part of the thirties was the introduction of a new range of spotlights with

Fresnel lenses. For the first time it was possible to have large diameter lenses (up to three feet) close in front of a powerful light source, either arc or tungsten, as well as a parabolic mirror behind the source. The efficiency of the source and its controllability were vastly increased, and these units have remained standard from that date to the present. The range available extended all the way from 500 watt tungsten spots to the biggest arc spotlights, and all had a beam spread that could be adjusted handily from 8 to 40 degrees, with a soft edge over a few degrees where the intensity fell off very rapidly to zero.

Even more completely than previously the main lighting of scenes in Hollywood movies was now executed with spotlights, and floodlighting was restricted to a certain amount of general fill lighting on sets or close-ups.

But the new Fresnel spots were slow to arrive in Europe, and even in the late thirties the main lighting of shots continued to be done with floodlights. The unavailability of big arc spots for extra figure lighting on location is quite obvious in Carné's *Quai des Brumes* (1938) and in Claude Renoir's work for his uncle, for instance. Of course satisfactory results could be obtained on the generally smaller European sets with floodlights, and indeed the look of the lighting was in the strict sense of the term more naturalistic than the American approach, but the point is just that European cameramen could not have produced exactly that Hollywood style if they had wanted to. The position in Britain was as usual intermediate.

There, with the somewhat superior equipment available, George Périnal was able to create the apotheosis of the European style in a series of Korda productions that he lit in the late thirties. The way of the best European film lighting since about 1913 had been to light the set and actors as one unit, and to apply no separate light (or very little) to produce special modelling on the actors. Périnal managed to combine an elegantly simple disposition of the major shadows on the set with glossy treatment of the figures at the appropriate moments. This creation of simple large geometrical shapes in the solid black shadows cast on the background of shots means that Périnal's lighting is probably the only work in the late thirties that

can be attributed to its author without prior sight of a film's credits.

Throughout the later thirties in Hollywood photography continued to be conducted at, or near, maximum aperture and in general the faster stocks were not used to achieve smaller apertures and hence greater depth of field. This was also true of European practices. (For the last time, there is *no* true "deep focus" in Renoir's films, just staging in depth, sometimes beyond the limits of sharp focus.)

CAMERA LENSES

At the beginning of the thirties lenses with focal lengths from 25mm upwards were available as before, and were used, and the usual maximum aperture of wide-angle and standard lenses was around f 2.5, though the Taylor-Hobson series had a maximum aperture of f 2. The importance of the maximum aperture of the lenses commonly used, apart from its relation to depth of field as already indicated, stems from the continuing desire of film-makers to use lens diffusion ("soft focus") in varying degrees throughout films. It does not seem to be generally known that the aesthetic convention of "soft focus" in cinematography stems from its use in still photography in the early years of this century. By 1914 still cameras with special "soft focus" lenses were being mass-produced for amateur use, and around 1915 "soft focus" Close-Ups began to appear in American movies. (But *not* those of D. W. Griffith.) The extensive use of lens diffusion, especially but not only in close-ups, had become common by 1925, and since lens diffusion, whether it is carried out with gauzes, vaseline plates, or specially made lenses, is most effective at maximum lens aperture, so photography at, or near, maximum lens aperture had become usual by that time.

The practice of maximum aperture photography thus has nothing to do with the introduction of panchromatic film a year or two later, contrary to what is often claimed in discussions of the development of deep-focus cinematography. The further reduction in depth of field visible in early sound films is largely due to quite another cause. The simultaneous use of several camera booths in filming scenes on many sound films

made in 1928, 1929, and to some extent into 1930, forced the use of longer focal length lenses to get tighter-frame, apparently closer shots than was the case both before and after. For instance, in the years mentioned a Medium Shot would quite probably be taken with a 75mm lens rather than the usual 50mm lens, and consequently the depth of field was even further reduced, becoming so shallow that everything but the actor was conspicuously out of focus. With the appearance of blimped cameras it was of course once more possible to get the camera, fitted with any lens, as close as one liked to the actors, so the extreme of shallowness of field disappeared again.

As a further complication, around 1929 and 1930 there was a minor school of thought in the studios which considered that lens diffusion should be dropped entirely as the "realism" added by synchronous sound demanded that everything in the image be sharply visible. This idea had a limited and passing influence, but may have been responsible for such peculiarities as the absence of lens diffusion throughout all the close shots of King Vidor's *Hallelujah* (1929), and nearly all other shots too, but on a couple of Very Long Shots heavy diffusion is used—remarkable inversion of the standard procedures.

Once into the thirties, sets were being designed on the assumption that the Long Shots would be taken with a 40mm lens. For closer shots a 50mm lens was once more the usual choice, and of course for Close-Ups something like 75mm.

In 1932 the Taylor-Hobson "Varo" variable focal length lens became available, and had occasional limited use in Hollywood for a few years. (The term "zoom lens" had not yet been coined.) The focal length of this lens could be continuously varied between 40mm and 120mm, with a possible maximum aperture of f 5.6. Apart from the rather small maximum aperture, the drawback of this lens was the fact that the focus was fixed at the hyperfocal distance, and closer objects had to be focussed by putting supplementary lenses in front of the front element, so focus-pulling in the middle of the shot was impossible. A further drawback was that the lens casing was a large and heavy oblong metal box about half the size of the body of a Mitchell camera. Zoom shots made with the Varo lens can

be seen in the street scene opening of *Love Me Tonight* (Mamoulian, 1932) and also in the stag-hunting scene. It was also used in a number of other films at this time, but hardly ever in later years, although it continued to be available, and the last use I have detected was in a montage sequence of *Private Worlds* (LaCava, 1935).

CAMERAS

In 1930 Warners were the only studio still using the "ice-box" type of sound-proof booth containing both camera and operator for sound filming, and from 1931 all the studios were using Mitchell NC cameras in blimps of their own various hand-made designs. So although Warners had fitted some of their booths with wheels, as had other studios during 1929, there was still during 1930 at that studio a strict limitation on the use of panning simultaneously with tracking, a limitation that no longer obtained elsewhere. (Cameras inside sound-proof booths were naturally limited by the size of the booth window to pans of about 30 degrees on either side of the forward direction, whereas both unblimped and blimped cameras can obviously be pointed in any direction while the dolly they are mounted on is being tracked along.)

The prototype Mitchell BNC was produced in 1934, but this camera was not put into series production till 1938. However Gregg Toland acquired and used one of the prototypes years before it was put on sale, but with no visible effect on the style of his camerawork at this point. In 1935 another silent camera was designed for Twentieth Century-Fox, and in 1939 several were produced for the sole use of that studio, but further production was prevented by the precision engineering requirements of World War II. Both the Fox camera and the Mitchell BNC were slightly easier than earlier cameras to get into extreme positions, and slightly easier to use in general, but this really had little significance as far as studio filming was concerned. What was important was that synch-sound shooting with lenses of wider angle than 25mm was now possible. (Blimped cameras had been restricted to using lenses of focal length longer than 25mm) However the effect of this was not to be realized till the forties.

CAMERA SUPPORTS AND CAMERA MOBILITY

Most of the major studios had acquired large camera cranes in imitation of Universal, and small cranes with a rise and fall of several feet appeared at Paramount in 1933, and at other studios shortly after. Naturally the improvised steerable dollies which were already in use for sound shooting continued to be used. On these the blimped camera was mounted on a heavy-duty tripod whose feet were fastened to the dolly platform. The pan and tilt head used under the blimped cameras was of the heavy spring-loaded friction type controlled with a pan bar, just like the still existing Mitchell and Vinten types. In 1930 Mole-Richardson had produced a large cradle geared head like the current types, having much faster and smoother pan and tilt movements than the small silent-period geared heads, but for some unknown reason this was not used till the end of the thirties.

Although tracking shots with synch-sound appear in a number of films made in 1929, for instance *The Saturday Night Kid* and *The Virginian*, not to mention the well-publicized instance of *Applause*, it must be realized that these are all instances of *parallel* tracking shots, in which the camera moves on a straight path with the actors, and without any large panning movements, for of course the camera and operator were inside wheeled booths, as already mentioned. However there were some films made in 1928 and 1929 which do show free panning and tilting on tracking shots; films such as *Hearts in Dixie* (1928) and *Chinatown Nights* (Wellman, 1929). But in these cases the shots in question were taken with an unblimped wild camera, and the sound laid under the shot in the editing. In fact the latter film appears to be a rare case of an entirely post-synchronized Hollywood film made in 1929.

Once the blimped cameras were on friction heads and dollies, the way was open to a complete continuation of the extensive use of the mobile camera that had characterized the work of many directors at the end of the silent period. At the beginning of the thirties obvious names like Pabst and Milestone spring to mind, but this very conscious trend spread to many directors, includ-

ing newcomers like George Cukor and John Cromwell (as commented on by the latter at the National Film Theatre, London, in 1974).

The prototype of a small, extremely maneuverable dolly was used on Milestone's *The Front Page* in 1931, and this dolly was put into series production in 1932 as the Bell & Howell "Rotambulator." It had a camera mounting that could rise and fall beside a central column, and this column was fixed in turn to a circular base about three feet in diameter. There were three small wheels around the circumference of the base, two at the front with fixed direction, and one at the back that was steerable. This arrangement permitted very tight turns to be executed, and the Rotambulator's maneuverability (but not its stability) approached that of present crab dollies. The effect of its use can be seen in the press room scenes of *The Front Page*.

The Hollywood extreme of the "long take with mobile camera" style can be represented by John Stahl's *Back Street* (1932), which with an Average Shot Length (A.S.L.) of 23 seconds inevitably includes a fair number of takes that are minutes long. (The roughly Poisson-type distribution of shot lengths in mainstream feature films enables one to know very roughly how many shots there will be of any given length in a movie once one knows the A.S.L. and the total duration of the film (see *Film Quarterly*, Vol. 28 No. 1, 1974).

In the instance quoted, and in others as Pabst's *Kameradschaft*, this style tends to be associated with a push towards naturalism in other dimensions of the medium such as dialogue and acting. The connection is not absolute, as witness the rather stylized acting in Renoir's *Boudu Sauvage des Eaux* (1932), which has an A.S.L. of 15 seconds, but nothing much in the way of tracking shots.

None of the dollies or cranes that became available in this period permitted minimum lens heights much below three feet, and ultra-low camera angles continued to require special time-consuming measures; nevertheless they continue to make their appearance in a few films such as *Doorway to Hell* (Archie Mayo, 1930) and others, the inspiration presumably being various European films such as *Battleship Potemkin* which had arrived in America right at the end of the

twenties. Unmotivated high angle shots are slightly more frequent, though still not common in non-musical films. A good place to study the use of these, and other, expressivist or "expressionist" devices at the Hollywood extreme of the expressivist-naturalist spectrum is *The Bat Whispers* (Roland West, 1931).

BACKGROUND PROJECTION

From 1930 the earlier travelling matte systems (Williams and Dunning processes) for combining live-action foreground scenes with separately filmed live-action background scenes were abandoned entirely, and replaced with background projection. In this latter process a previously filmed background scene is projected in the studio onto a large translucent screen from behind, while the actors are filmed from the front of it, acting against the image on the screen to produce a combined image giving the illusion that they are actually in the location shown in the background. The very first background projection screens were made of ground glass, and were limited in height to several feet. They were also prone to show a "hot-spot"; that is, the part of the image near their center photographed brighter than the parts at the edges. Attempts to use other materials to make large screens had other drawbacks, as can be seen in *The Dawn Patrol* (1930). Here very large screens, presumably made of some thin white cloth, were used in the final ground scenes showing the bombing of the German factory. The image of the distant parts of the bombed factory back projected onto the screen are partially obscured with an all-over wash of white, either from the screen material itself, or from flare in the optical system of the projector. The result is a glaringly unconvincing mismatch between the background and the actors and parts of set built in front of the screen. Earlier in the film close shots of pilots in aeroplanes made in front of smaller back projection screens are satisfactory because the effect is less marked, and also because one expects aerial haze to wash out the background in the real situation being mimicked.

Because of these flaws, background projection was limited to showing things like the passing street through the back window of cars, where

small screen size does not matter, until a new cellulose screen material and redesign of the optics of background projectors in 1932 made possible satisfactory projection on screens as big as 17 feet by 23 feet.

The new possibilities of background projection after that date can be studied with advantage in *King Kong* (1933), where all the combination of animated models with live action is achieved by background projection, often with the new large screens, though it would appear that the new fine grain background negative stock was not available when the film was shot. (It must be emphasized that in this film some of the combination of actions in *different* parts of the frame is achieved with the much older fixed matte procedures. Also in one or two shots the silhouettes of birds flying past are made by simple superimposition.)

As a result of the unavailability of good background projection during the early thirties, many films continued to include synch-sound location dialogue sequences, some of them quite lengthy, whereas after 1933 such scenes are very rare. Naturally the point about shooting what purport to be exterior dialogue scenes in front of the background projection screen is that it gives total control over the environment—lighting, weather, and background noise—and hence more efficient production. The reduction of background noise was particularly important given the microphones available in the thirties.

OPTICAL PRINTING

Optical (or projection) printers involve the frame-by-frame projection of an already shot film through a system of lenses and the frame-by-frame refilming of all or part of the projected image with an accurately aligned camera. In the twenties there were one or two specialist firms in Hollywood that had their own hand-built optical printers, to which the studios sometimes contracted out special effects, but the lack of satisfactory duplicating negative and positive stocks restricted the use of such printers. When duplicating negative and positive film with fine grain and low contrastness became available at the beginning of the thirties, this permitted combinations of shots to be made in optical

printers and then re-copied with hardly any noticeable deterioration in quality, which had not been the case before. Series-built optical printers were made and sold by such firms as DePue from 1930, and with these, or others constructed by their own technicians, the studios set up their own optical printing departments. Immediately such effects as front titles printed over live action at the beginning of films started to appear, followed by the wipe as a shot transition from 1931. (Various approximations to the wipe had been occasionally tried from 1918, but it was impossible to make an in-the-camera wipe accurately at every attempt.) The first wipes were straight-line replacement wipes with hard edges, but other shapes were flirted with, and the edge of the wipe line rapidly became slightly blurred. The availability of optical printers and duplicating stocks also encouraged the proliferation of "montage" sequences with a faster flow of shots than had been the case in the late twenties. In fact there was close to a qualitative change in the typical montage sequence: from a series of short shots linked by dissolves to a continuous series of dissolves end-to-end giving the effect of a continuously changing superimposition. Such an effect was of course impossible to create in the camera, as the late silent-period montage sequences were created.

In the late thirties there were virtually no new developments in this area in America; one should note only an imperfectly successful attempt at travelling mattes in the "Bojangles" scene of *Swing Time* (Stevens, 1936). In Europe optical printers came into use in 1934-35, but the montage sequence never became as widely used as in the United States, possibly partly because the studios tended to contract their processing out, and did not maintain their own optical effects departments, and hence the use of montage sequences was relatively more expensive.

The wipe continued to be used more and more to indicate a short time lapse, and its edge got more and more blurred.

EDITING

The basic tool for sound editing had already been introduced at the beginning of sound film-making, and this was the multiple synchron-

izer just as we know it today in its unadorned form without track reading heads. Originally its purpose had been to keep the several simultaneous picture tracks obtained from multiple camera filming in synchronism with each other during editing, and hence finally with the sound-track disc, but by 1930 both multiple camera filming and sound on disc were abandoned. The synchronizer was then used just to manipulate the series of pairs of picture track and sound-on-film track, and keep them in synchronism during editing. This simple procedure gave no way of hearing the words on the soundtrack, was extremely inefficient, and was not conducive to scene dissection into a large number of shots.

But in 1930 the sound Moviola became available, and from 1931 the Average Shot Lengths in Hollywood films started to drop. The sound Moviola was a simple adaption of the silent Moviola, with a continuously moving sprocket drive pulling the sound-track film under a photo-electric sound head identical to that in a sound projector, the whole unit being mounted beside the standard Moviola picture head, and driven from it in synchronism by a rigid shaft drive. Basically the machine was the same as the present "Hollywood" Moviola, except that the picture was viewed through a magnifying lens, and not back-projected on to a tiny screen. The sound track could be moved slowly by hand under the sound head, and the exact position of any part of a sound identified.

The other development that facilitated the fast cutting (in both senses) of synch-sound shots occurred in 1932, with the introduction of "rubber numbering" (or "edge numbering") for sound and picture tracks. "Rubber numbers" are footage numbers stamped in ink down the outer edge of the picture and soundtrack for each shot. The numbers coincide at the points on the sound track and picture track where the corresponding image and its sound lie. After numbering has been carried out it is possible to shuffle about sections of picture and sound-track in the editing process with perfect freedom, secure in the knowledge that synchronism can be regained when necessary, purely "by the numbers."

As a result of the freedom provided by both these developments, the Average Shot Length in

films of this period started to decrease in a way that can be exemplified by the work of William Wellman; *The Public Enemy* (1931) has an A.S.L. of 9 seconds, *Wild Boys of the Road* (1933) has an A.S.L. of 6.5 seconds, and Wellman stayed remarkably close to this latter figure for the rest of his career. Particular advantage of the possibility of speeding up the cutting rate was taken at the Warner Brothers Studio, and this effect can also be seen in Michael Curtiz's films, but the pressure was not absolute, as can be seen from the work of Mervyn Leroy who stayed with a slower speed (*Tugboat Annie*, 1933, A.S.L. 9 seconds) and some camera movement. (It is obviously difficult, though not impossible, to use camera movement in a large number of shots when the A.S.L. gets down to around 6 seconds.) The other extreme of cutting speed, which was commoner in 1930 than 1933, can be represented by John Stahl's *Only Yesterday* (1933), which has an A.S.L. of 14 seconds.

The trend towards faster cutting in many films in the middle thirties can be easily explained as a desire on the part of many people to return to the sort of cutting that had been usual in the majority of American silent films made in the late twenties, when Average Shot Lengths were usually down around 5 seconds. And once the restrictions on cutting sound had been removed by the sound Moviola and rubber numbering, they were free to return towards silent cutting speeds as far as the length of the average line of dialogue would let them. Then after some years of that sort of thing, many directors were ready for a new fashion which appeared, and which will now be discussed.

It was only in the middle thirties that the technical developments in editing procedures introduced prior to 1933 had their full effect. For the period 1934-1939 the mean Average Shot Length for Hollywood movies was around 8-9 seconds. (This figure has been derived from a fairly random collection of over 50 films. Although there are not enough results to make a year-by-year estimate of the mean figure, it is fairly clear that the minimum was achieved round 1935. This means that most directors were taking advantage of the ease of making a large number of cuts in a scene, but there was still a wide

spread of characteristic Average Shot Lengths from director to director.) But by 1939 a new tendency in the opposite direction was just beginning to appear, a tendency towards long takes that only became fully developed in the forties.

To give some examples, George Cukor moved from A.S.L.s such as 17 sec. for *Dinner at Eight* (1933) to an A.S.L. of 10 sec. in 1935 for *Sylvia Scarlett*, and then back to long takes for *Holiday* (1938) (A.S.L. of 14 sec.) and *The Women* (1939) (A.S.L. of 13 sec.) and subsequent films. Obviously this sort of movement with the trend was the most common (e.g., Wyler, Hawks), but there were also a number of directors who stuck with what they were doing at the fast cutting end of the spectrum. For example, Curtiz had already arrived at an A.S.L. of around 7 seconds in the early thirties, and he continued right through with the later thirties and into the forties in the same way: *Charge of the Light Brigade*, (1936) has an A.S.L. of 7.5 sec. and *Dodge City* (1939) has an A.S.L. of 7 sec.

On the other hand it was possible to go against the tide, as John Stahl quite remarkably did. From an A.S.L. of 13 seconds in *Imitation of Life* in 1934 he went on to use even longer takes in *Magnificent Obsession* (1935) which has many shots some minutes long, and an Average Shot Length of 26 seconds. Even more remarkably, these long scenes are mostly carried out in "profile two-shot," with two performers facing each other, and there is very little staging in depth in the manner used in Europe by Renoir, and to a lesser extent Marcel Carné and others who used long takes. But none went to such lengths in this period as Stahl did. However by 1939 Stahl had retreated from this extreme position (*When Tomorrow Comes* has an A.S.L. of 14 seconds), and by the forties he was working near the norm for those years.

It might be thought that Average Shot Lengths are related to the genre of the films concerned, and not specific to the directors, but this is only so to an extremely limited extent. The only important cases so far discovered after checking several hundred are those of the musical, where if one includes the musical numbers in the count, there is a definite tendency for a director to use

longer takes than he would otherwise. This conclusion is of course dependent on the assumption that the way the musical numbers were shot was controlled by the named director, which probably is not always the case. Another rare instance of the genre of a film dominating the way it is shot is that of the Tarzan films. Here the necessity of faking all the animal stuff ensured that the A.S.L. was always close to 4 seconds, from the thirties through to the fifties, regardless of who directed the films. Regular Tarzan directors such as Richard Thorpe never used such fast cutting on their later films.

On the other hand one finds consistency of Average Shot Length from comedies to dramas to action subjects in the work of directors such as Hawks and Wyler and so on throughout this (and other) periods.

SOUND RECORDING

1930 saw the final triumph of sound-on-film recording; sound on disc was phased out. Starting at the beginning of the sound recording chain, we note that the microphones used continued to be of the "condenser" (capacitance) type. If several microphones were being used to record sound for a shot, their signals were mixed directly before being recorded photographically on the sound negative in the sound camera, in electrical synchronism with the film camera. The mixing of a set of film sound tracks subsequent to their initial recording to give a final combined recording was very rare at the beginning of the thirties; the extra film recording stage introduced a perceptible loss of quality. (This loss of sound quality can be studied in those Laurel and Hardy films from 1931-32 which have continuous background music mixed with the dialogue and effects.) Thus, although post-synchronization of voices to a film scene could be carried out from 1929, it was mostly not used in the early thirties, and location scenes involving dialogue were always shot with direct sound, which naturally ensured that both the voices *and* all the effects went into the right place. This was extremely difficult to do in one pass when post-synchronizing without re-mixing and re-recording.

In some location situations ultra-directional microphones were created by putting an ordinary microphone at the focus of a large (up to 6 ft.) parabolic metal reflector. In this way *fairly* good recordings could be obtained at 15 ft. or more from the actors. Since otherwise all the microphones in use were omnidirectional, picking up sounds equally whatever direction they came from, background noise could be a serious problem with location recording, and this was one of the pressures encouraging the change to the shooting of "exterior" dialogue scenes in the studio as soon as good background projection made this possible.

Throughout the thirties there were more or less continuous improvements in the performance of sound-on-film recording systems through attention to various aspects of their functioning: exposure and development control of the sound track negative, amplifier circuit improvements, mechanical refinements of the sound cameras and printers, and so on. But the really audible advance in the quality of recording was largely due to the track noise suppression techniques introduced in 1931.

By 1933 it was possible to mix a separately recorded music track with the synchronous dialogue track recording after the editing stage without audible loss of sound quality at the extra film recording stage, and from this point on "background music" came to be used more and more extensively. (Up to 1932 there was, roughly speaking, either dialogue *or* music on the sound track, but never both together unless they had been recorded simultaneously. Which they sometimes were.) As the kind of improvements already mentioned continued into the late thirties, including then the important introduction of "push-pull" double sound tracks in the RCA system, it became possible to do multiple-channel music recording on *One Hundred Men and a Girl* (Henry Koster, 1938) and other subsequent musical films.

Putting the situation in another way, there was now full freedom to assemble as complicated sound tracks as could be desired, going through several recording stages if that was necessary.

TECHNICOLOR

The Technicolor three-strip camera was to a certain extent modelled on the Mitchell, and was not all that much larger, except that the magazine was three times as wide to accommodate the three rolls of negative side by side. Unlike the Mitchell cameras there was no rack-over arrangement for rapid "through the lens" viewing of the image, and focusing had to be done entirely by the scale on the lens. The larger reliance on the supplementary viewfinder so caused may have produced a tendency to less precisely composed images in Technicolor when compared with the best black and white photography of the late thirties and forties.

Because of the prism block between the back element of the lens and the film gates, ordinary lenses could not be used in the Technicolor camera, and a special set was designed and made by Taylor-Hobson Ltd., but it included no wide angle or very long focal length lenses. Technicolor photography in the studio was carried out at, or near, maximum aperture by necessity, for in the initial period up to 1937 negatives were slower than twenties black-and-white negative, and the key-light level needed for correct exposure was very high. But in 1939 new negative stock was introduced (it was used on *Gone With the Wind*) and this stock was two to four times faster than the earlier material, being considered to have a speed equal to Super X (40 ASA). But even with this improvement, the speed of the film was not great enough, when taken in conjunction with the unavailability of wide-angle lenses for Technicolor cameras, to permit any sort of Toland-style deep-focus on Technicolor films made in the forties.

Flood lights were used rather more for Technicolor lighting than they were in the late thirties for black-and-white filming, which made for flatter lighting, and this fitted in with the usual desire of producers and the Technicolor organization to show as much color as possible in each image. The use of a fair amount of strong chiaroscuro, as in *The Garden of Allah* (1936), seems to have been discouraged, and on the other hand the strikingly modern simplicity of the lighting of *The Trail of the Lonesome Pine*, done

by W. Howard Greene with only a few lights per scene, was not popular either.

A frequent feature of lighting for Technicolor, which persisted for decades, first appeared in *The Private Lives of Elizabeth and Essex* (1939) as lit by Sol Polito and W. Howard Greene. This was the practice of splashing areas of amber light and blue light on the backgrounds of "period" interior scenes without regard for any consistency with possible sources, the actors being lit with white light.

In 1937 the Technicolor process was capable of quite accurate reproduction of colours on natural exterior scenes, the true gauge of performance, as can be seen from original prints of *Ebb Tide*, for instance. Initially the system was extremely contrasty, roughly comparable in this respect to present (1976) broadcast-quality color video, the unfill-lighted shadows were solid black, and very bright areas such as white clouds had a tendency to burn out (i.e., become undifferentiated transparent areas on the positive print). However with the advent of the new camera negatives in 1939 this contrastiness was somewhat reduced. As far as faithfulness of color reproduction is concerned, it must be noted that for a couple of years, starting in 1937 and ending in 1939, it was the usual practice to make Technicolor prints with an overemphasis in the direction of orange, and such prints do not provide a true idea of the fidelity that the system was capable of at that time. (Further warning: A number of early Technicolor films such as *Becky Sharp* and *A Star Is Born* were later reissued in two-color Cinecolor prints, and these have very little relation at all to the color, definition, and contrast of the original prints.)

Because the light level on a background projection screen has to match the light level of the scene being filmed in front of it, the large light levels required for Technicolor before 1939 prevented the use of big BP screens, the upper limit being about ten feet. After 1939 the problem was minimized by the faster stock then available, and also by the development of triple background projectors at Paramount and Warners—the images from three projectors perfectly superimposed on one screen to give three times the screen brightness. But this restriction on background

projection may have contributed to the large amount of location shooting in many of the Technicolor films of this period when compared with the usual practice in black-and-white filming in the late thirties.

Although the basic Technicolor camera was not much bigger and heavier than a Mitchell NC, the blimp for the Technicolor cameras was much bigger and heavier than the usual blimps made for Mitchell cameras. (Its dimensions were about two feet by three feet by three feet.) It might be speculated that this bulk and weight militated against using the larger number of camera set-ups that were required by the shorter end of the Hollywood A.S.L. range. Certainly Wellman's *A Star Is Born* (1937) has an A.S.L. of 9.5 seconds compared with his habitual 5 to 6 seconds, and Henry Hathaway, who also worked in the same range in his black-and-white films, went up to a slower cutting (A.S.L. of 7 seconds) in *The Trail of the Lonesome Pine*. It is doubtful if this effect extended to a pressure on those directors working near the mean Average Shot Length; Ford's *Drums Along the Mohawk* has an A.S.L. of 9.5 seconds, which is quite close enough to his usual black-and-white figure of 9 seconds.

NARRATIVE CONSTRUCTION

The early thirties were a period when the brightest spirits were very active in trying out new devices for narrative construction in the mainstream sound cinema, and most of the instances are well known. Nevertheless for the sake of completeness we must mention such features as depend on the use and existence of a sound track as the internal monologue in Hitchcock's *Murder* (1930), the visual illustration of speeches continued on sound only in Fritz Lang's *M* (1931), the subjective camera sequence opening Mamoulian's *Dr. Jekyll and Mr. Hyde* (1932), and the jump cuts given continuity by dialogue continuing across them in Clair's *A Nous La Liberté* (1932). Less well known is the narration of *The Power and the Glory* (W. K. Howard, 1933) through a series of nonchronologically arranged flashbacks, and even more remarkably, in one flashback as the narrator quotes the dialogue used on the past

occasion visually represented, his words coincide with the lip movements of the characters in the flashback so that he speaks their dialogue for them. Possibly the first occasion when the audience was addressed directly in a sound film was at the end of *Big Boy* (Alan Crosland, 1930), at which point the camera pulled back to reveal that what had seemed an ordinary film to that point was taking place on a theater stage. More importantly there are of course the asides to the audience in Lubitsch's *The Smiling Lieutenant* (1931) and *Love Me Tonight* (1932).

Finally one must also mention the use of zip pans as a transitional device to indicate time lapse in *The Trial of Vivian Ware* (William K. Howard, 1934).

The later thirties were the cinema's most restricted and restrictive period, and although as already indicated films continued to occupy a large range in most of the major formal dimensions of the medium, there was very little indeed going on at the innovative extremes. Even documentary films, which had to a certain extent taken the place of the by then nonexistent avant-garde, were rather timid in the main, and one cannot point to much more than the rhythmic sound-and-poetry tracks of Cavalcanti's *Coal Face* (1935) and its successors, and the peculiarities of Dziga-Vertov's *Three Songs about Lenin* (1934). In feature films Dovzhenko's *Aerograd* (1935), with its interjected choral songs illustrated on the picture track, springs to mind, but otherwise one is left with a very few individual cases such as the innovative games played with the medium in Sacha Guitry's *Roman d'un Tricheur* (1936).

Overall, one can say that the very general trend in the early thirties in mainstream cinema was back to the style of the last silent films, 1928 vintage, as soon as the various technological constraints on putting a film together were relieved. Having reached this point about 1934-35, new technical developments began to have some effect on film photography, and at the end of the thirties a new trend towards longer takes was just starting to emerge independently of any technological pressures—a trend that was to flourish in the forties.